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TRAINING PROGRAMS IN REMOTE SENSING FOR PROFESSIONALS,  
STUDENTS AND THE GENERAL PUBLIC

R. Galeano

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Reunión de Expertos en Ciencia y Tecnología Espaciales sus  
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16. Abstract This speech, presented at a symposium on space science and technology within educational systems, describes what remote sensing is, how and why it is used, and why more people should be trained in the field. Suggestions are offered concerning differences in teaching technicians, the general public, and children in schools.			
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TRAINING PROGRAMS IN REMOTE SENSING FOR PROFESSIONALS,  
STUDENTS AND THE GENERAL PUBLIC

R. Galeano

1. WE LIVE IN A TIME OF ACCELERATED CHANGE

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Let's suppose that mankind does not have 500,000 but only 50,000 years of history. In order to make this information more comprehensible, let's reduce this to a simple figure of 50 years. On this time scale, only 10 years ago we stopped being cave-dwellers; 5 years ago we invented pictorial writing; 2 years ago Christianity began; 15 months ago we had the first press; 10 days ago we used electricity; the night before last the first airplane flew; yesterday morning the radio was invented; last night television began. When we began to read this article the commercial jet was constructed; and fractions of a second ago we arrived on the moon. When we finish this paragraph we will have commercial satellites whose onboard sensors permit one meter resolutions.

If we look at human knowledge we find a constant similar to the velocity of change: from Christ to 1750 human knowledge doubled once; from 1750 to 1900 it doubled again; from 1900 /2 to 1950 it doubled once more; from 1950 to 1960 it doubled yet again; from 1960 to 1965 it doubled one more time. As time continues, it seems that with each day a shorter period of time is needed for knowledge to double.

The transition from scientific discovery to commercial use shortened in similar proportions. From scientific discovery to industrial use, 112 years were needed for photography, 56 years for the telephone, 35 years for the radio, 15 years for radar,

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\*Numbers in the margin indicate pagination in the foreign text.

12 years for the television, 6 years for the atomic bomb, 5 years for the transistor, and 3 years for integrated circuit.

We live in a time of constant change that imposes new ideas in our education. According to Pierre Massé, "Even if man were to remain in the same place, things would change around him. There are too many aging ideas, completed events, techniques which have become obsolete, antiquated cities. And at the same time, there are too many new ideas, unpublished events, undescribed techniques, cities without roots."

If we think about the school of tomorrow and what education will become within the next 30 years in developed countries, we will be able to foresee a reality that will represent for us the possibility of a great leap, similar to the one we made when we went from the mule to the airplane.

Physically, the school of the year 2000 will have the following characteristics: there be no heating or refrigeration units; the most appropriate environment will be maintained for each of the activities accomplished through ionization processes; all means of communications will go through wireless systems, there will be no pipes: nothing will be wasted, everything will be decomposed and chemically transformed for later use; there will be no walls: magnetic waves will 13 balance the sound, and light rays will form visual barriers. There will be large communal centers learning which around 600,000 students will regularly attend. In these centers there will be no classrooms as we know them today, but rooms for group discussion in which the professor will be only one more participant. The furniture used in the school of tomorrow has not yet been invented. Each student will have an individual capsule in which the environment will be perfectly conditioned for that particular student; in the capsule he will have at his disposal a television screen, a telephone which will link him to a computer circuit, and a teaching machine which, among other things, however, will not replace the teacher.

Children will begin school around the age of 2 1/2 years. High school degrees will be given at the time that the 12 to 15 basic concepts, which will not be learned in regular courses, are mastered. The majority of adults will regularly attend courses and seminars. Fifty percent of the time will be dedicated to individual learning. Students will begin to attend a university at the age of 15. The program will last, in many cases, 10 years, while titles and degrees obtained should be renewed every 5 years.

We live in a time in which change and accelerated change are natural. The previous facts make us begin to think about what knowledge was until approximately 1900 and what it is today.

## 2. THE NATURE OF KNOWLEDGE UNTIL 1900. THE ROLE OF THE PROFESSOR AND THE STUDENT.

Until the invention of the press 500 hundred years ago, information was transmitted from person to person. /4  
Gutenberg made it possible that scarce documentation which accumulated for centuries was at the disposal of a great number of people.

Until the end of the last century knowledge was more or less contained by the human mind and the learned man was the one who possessed practically everything which was known. The professor's job was to collect information. The professor was the repository of truth, an absolute truth. His duty was to present this truth to his students and defend it before them. In general, all doubt and contradiction on the part of student constituted disrespect; all doubt on the part of the professor was considered ignorance; to accept an unknown theme implied the loss of professional prestige and the respect of the students. The professor was correct and should act based on that premise.

The student's job was to learn what the professor said to him. He should try to pull the maximum amount of information

possible out of his teacher. His function was not to discuss or to doubt, but to memorize. The student was expected to know the formulas, the facts, the correct techniques, the right answers. To learn was to collect some information and know the scientific truth about it. On the day of the exam the student was expected to return to his professor everything which had been passed on to him. When the student knew as much as his professor, he was able, in time, to become a professor.

### 3. THE NATURE OF KNOWLEDGE AFTER 1900. THE ROLE OF THE PROFESSOR AND THE STUDENT

The constant search for better means of communication and transfer of information step by step lead to the invention of the telegraph, the telephone, the phonograph, photography, and the radio. Around the middle of the century, technology 15 considerably multiplied the possibilities of transferring information. In response to an enormous explosion in the rate of scientific investigation, a true revolution, largely financed by the superpower governments, took place in information methods.

With the rise of scientific investigation and the consistent development of great theories, the majority of knowledge becomes relative and, instead of only one point of view, there are now many with which to reconcile. We possess only facets of the truth. The facts of course continue to be important, but perhaps what is more important is the point of view from which one can continue to call them facts.

If we consider that the highest percentage of scholars and technicians that mankind has produced are still living today, that each year produces some 10 percent more scholars than the previous year, and that the means of investigation becomes more abundant each time, we have to conclude that the best level of actual knowledge is only one stage in scientific development and therefore, cannot be considered definitive or absolute.

Knowledge of things and information alone will not have any meaning, just as having the ability to repeat names and formulas will no longer have any meaning. What will distinguish man from machine is the imagination, inspiration, intuition, the creation of ideas, which is characteristic of the spirit. Man will have as partners a memory and the calculating capacity of a machine which are characteristics of the computer. This new association will create an unknown intellectual dimension, that in time will shape a different world.

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At present, the professor is not, nor can he be any longer the repository of truth; he now can recognize that lack of knowledge about a theme or some information, even if it is within his own specialty, will not cause him to lose his authority. He can no longer hope that they will accept his reasons only for the fact that he is an authority. Furthermore, today he should realize that he is much more unaware of what he knows; he should know that he will learn a lot from his students; he should maintain a critical attitude toward his own opinions, surpassing any possible objection. Transmitting knowledge became a guide in the student's searching and learning processes. A good professor no longer teaches, but learns with the students.

At present, the student can no longer hope to become the repository of truth. To know information from information does not have any meaning and, in the same manner, trying to know everything about everything does not have any meaning.

The student should try to investigate, after which he should articulate all the information he receives - images, ideas, and facts - into some personal system of concepts which serves as a point of reference for new learning and revising processes of obsolete knowledge. The fundamental labour in this field should be that of giving meaning to one's concepts system in such a way that one's personal synthesis resists analysis and

criticism and is susceptible to changes. The indiscriminate memorization of facts, ideas, and principals is useless and frustrating.

In the field of teaching, we do not impose our will on the student, but we initiate it in diverse areas of heritage in which we ourselves intend to live and to whose improvement we find ourselves dedicated.

Education is not an imminent operation within the confines of four walls of a classroom nor should it be only the interaction between the student and the professor. (This /7 is what some experts call the concept of the 2 x 4 education: that is, the interaction between the professor and the student is represented by the numeral 2, and the number of classroom walls is represented by the numeral 4).

A culture is a system of characteristically intertwined elements which form a very complex mold. Sociologists prefer to see education as a part of that mold.

This topic is extremely complex. Therefore, whatever innovation or change that occurs on the part of the culture will affect not only many parts of the culture, but the culture mold as a whole. This can occur with the introduction of tools, ideas, operative modes, etc. The relationship between the change of elements of the cultural mold and education then becomes evident. Therefore, there is an opposition to new ideas. A reorienting action of values could have conflicting results. Consequently, a cultural patron set in his beliefs is inclined to continue in the status quo and remain suspicious to change. In the case of adult students, this is one of the more serious problems. They can have "a way of seeing the world" and in that sense form a subculture. Smaller social groups within a culture, could be analyzed in the same way that a culture is.



These small groups form what is called a subculture. Poverty, for example, is a subculture.

In short, I hope to have shown thus far that education in general is not an activity confined to methodology nor to the professor-student interaction. It is not a simple question of finding an effective mean and applying it in the classroom. A better question is one that includes all of society, all of the culture. /8

Perhaps only the distant primitive man, primitive in the strictest sense of the word, that is, the one who woke human nature, lived for a period of time in a natural state. Shortly thereafter, human nature began to reveal itself by creating manners and various forms of conduct which in general constitute culture. From the so-called primitive towns up to the highly developed cities, culture represents the environment which envelopes them. There is no town which lives without a culture.

This process by which the older generations transfer their culture to the new generations precisely turns out to be EDUCATION. Education, let's say, is an instrument of service to the culture. It is not an end in itself. The culture constitutes the end; and education is the instrument which puts the existing cultural inventions within reach of the new generations. If there was no culture, there would be no need for education.

What we have here is the transcendental importance and intrinsic difficulties of education. For this reason education shows to new generations a mass of concrete experiences rather than the existing experiences themselves, simply because it is impossible to do.

Within a educator's concept, education is a simple teaching problem. It all boils down to relying on good professors, good

methods, good books, and good constructions. The main concern is the art of teaching and the search for a better way to do it. As a result of all this, young people should become fully educated.

The intellectualistic concept of education, unlike the previous concept, is concerned with content, whereas, before, the manner of educating was a concern. Education then becomes, in a way, a transmitter of knowledge, and teachers are 19 essentially the instructors or informers.

One cannot, with regard to this spectacle, stop harboring the suspicion that the intellectualistic and ascetic attitude does not help, temporarily at least, in protecting created interests and in avoiding the questions of a social and economic reality which is not always satisfactory. In this sense, the intellectualistic education, voluntary or involuntary, becomes a valuable ally of the status quo.

What do we mean, consequently, by university education? We mean an extremely complicated institution that goes beyond the exclusive use of methodology. We want to imply an activity which is deep rooted in the influences of a large society in the context of the classroom and vice versa: an activity that produces an impact on society through methods employed in the classroom. The education of university students also means an activity that should be fundamentally based on one's personal conception of the general problems of life, reality, knowledge, and values. Finally, we mean that the methods and techniques of university teaching can only follow and depend on careful, previous work which the specialist, the scientist, and the technician are in the process of accomplishing.

We do not have one true educative task. We have to be honest with ourselves. We have totally inverted the theory of

education in order to focus our strengths on the development of courses and have left other aspects out of our concerns. /10

Naturally, the new and ever changing field of remote sensing does not escape this situation. But, as I will point out next, there are factors and situations which impair the panorama.

#### 4. ESTIMATE OF THE POTENTIAL DEMAND FOR TRAINING IN REMOTE SENSING.

An ever present question in Latin American countries is how many experts are necessary to meet the needs of inventory and development plans of natural resources. The information on demand for experts is very deficient.

It is accepted that human resources constitute an essential component in "resources for development" which is one of the conditioning factors of initial and sustained development. Many international conferences reflect the conviction among countries that science and technology are critical factors in national development. One such conference sponsored by the United Nations declared, "Science and technology have contributed in creating the gap between prosperous and progressing countries and impoverished and underdeveloped countries. The shortage of scientists and engineers is an indicator of that gap."

The countries seeking a more or less accelerated growth have to agree on the overall importance of recruitment and training of scientists and engineers. McClelland (1966) has calculated that if a country plans rapid, economic growth, it should recruit and train 20 students on the intermediate level and two students on the superior level for every 10,000 inhabitants. If we put these indices into effect, Colombia would put out some 58,000 scientists, experts, and engineers in 1986, 20% of which should be experts in sciences dealing /11 with land (geologists, pedologists, foresters, hydrologists, geographers) and 25% of these (5% of the total) trained in

surveying and evaluating of natural resources. This takes us to an estimated 2,900 professionals specialized in the collection, analysis, and interpretation of information on natural resources.

Harvison and Meyers (1964) have established a relationship between economic development and human resources. They group countries into four classes according to the level of development and various indicators:

INDICATORS	GROUPS OF COUNTRIES			
	Level 1 (low)	Level 2	Level 3	Level 4 (high)
Professors from levels 1 and 2 of teaching for every 10,000 inhabitants	17	38	53	80
Scientists and engineers for every 10,000 inhabitants	0.6	3	25	42
Percentage of the population active in agriculture	83	65	52	23

If the human resource indices from levles 3 and 4 are /12 applied to Colombia and Latin America, whose estimated populations for 1986 would be 29,000,000 and 375,000,000 inhabitants (BID 1984), respectively, the demand for scientists and engineers would be:

	<u>Level 3</u>	<u>Level 4</u>
Colombia	72,500	121,800
Latin America	937,500	1,575,000

If 5% of scientists and engineers needed according to these indicators should be specialists in surveying, we would, therefore, need between 3,625 and 6,090 experts in Colombia and between 46,875 and 78,750 in Latin America. Assuming that an average of the figures for Group 3 and 4 countries is representative for the region there would be a demand for 62,813 experts. It would not be exaggerating to assume that 10% of these experts should be knowledgeable about remote sensing systems, since all modern cartographic systems are now based on the use of this technology. This would imply a potential demand for 6,281 experts who should train themselves in teledetection techniques and its application to development programs.

##### 5. ESTIMATES BASED ON THE INSTITUTIONS INTERESTED IN THE USE OF REMOTE SENSING

Remote sensing offers many possibilities, but the Latin American region does not have a clear understanding of its importance and usefulness. As a result, there are very few institutions that count on qualified personnel with a high level of understanding about this technology. The majority of technicians train themselves to only a level of short courses or an intermediate level.

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The Directory of the Environment in Latin America and the Caribbean, published by the United Nations in 1977, lists 666 institutions related to the environment and the study of natural resources. In order for these institutions to have the ability to modernize their work systems, they should have at least two technicians at the Master's level qualified in the use and

application of remote sensing. Therefore, there would be a demand for 1,332 technicians at the Master's level. In order to put together a functional work team, each one of these institutions should have at least four technicians at the specialists level and eight at the basic level. The potential demand, therefore, would be on the order of 2,664 qualified technicians in the regular courses and 5,328 in short courses.

According to the APICE-UNESCO (expansion unknown) Directory on the Superior Education in Latin America and the Caribbean, the universities of the region are training professionals in 215 careers in which remote sensing would be of great use. At least one professional from each one of these university careers should train himself to the Master's level. It is worth noting in this figure that the universities of Brazil and Argentina are not included; these countries can offer training in their own centers. The potential demand at the Master's level would be in the neighborhood of 1,547 professionals.

In the countries from Groups C and D (BID Classification) 397 institutions dedicated to the studies of environmental research exist. Their demand would be in the neighborhood of 794 technicians at the Master's level, 1,588 at the specialists level, and 3,176 at the technical level (short courses), which adds up to a potential demand of 5,558 experts, a figure comparable to that obtained from the Harvison and Meyers index of 6,281 experts. These countries would have an urgent need to train its personnel, but given the limits which arise in /14 sending them to highly developed countries where they would encounter a language barrier, high costs, and difficulty adapting to the environment, it seems more reasonable to advance such training within the region itself.

6. THE RELATIONSHIP BETWEEN POTENTIAL DEMAND AND MAXIMUM  
PREPARATIVE CAPACITY OF REGIONAL CENTERS

To create a common basis of comparison, we have adopted an index called "technician-days" which takes into account the number of training days necessary, according to the course level and the number of technicians in each course. Courses at the Master's level require 235 days (47 weeks), courses at the specialist's level require 175 days, and courses at the basic level require 60 days.

Translated into annual "technician days," the figures corresponding to the potential training demand for countries in groups C and D, according to table 4 would be:

Master's		
level course	:	794 tech x 235 days.189,590 tech-days
Specialist's		
level course	:	1588 tech x 175 days 277,900 tech-days
Basic level course:		3176 tech x 60 days <u>190,560 tech-days</u>
		655,050 tech-days

The minimum demand (one Master's level technician, one /15 at specialist's level, and two at basic level) for the countries in these groups would be:

Master's		
level course	:	397 tech x 235 days 93,295 tech-days
Specialist's		
level course	:	397 tech x 175 days 69,475 tech-days
Basic level course:		794 tech x 60 days <u>47,640 tech-days</u>
		210,410 tech-days

The following is the maximum annual capacity of existing centers in the region:

Vincente Lopez Remote Sensing Center of Argentina

Short course : 60 tech x 30 days 1,800 tech-days

Cartographic School of Panama

Short course : 220 tech x 32.5 days 7,168 tech-days

INPE [expansion unknown] Brazil

Master of Science

level course	:	17 tech x 235 days	3,995 tech-days
Short course	:	137 tech x 6 days	822 tech-days
Special course	:	20 tech x 30 days	<u>600 tech-days</u>
			5,417 tech-days

Interamerican Center of Land and Water Development (CIDIAT),  
Venezuela

Short course : 85 tech x 29 days 2,465 tech-days

Interamerican Center of Photo Interpretation (CIAF), Colombia

Short course	:	120 tech x 28 days	3,360 tech-days
Standard course	:	60 tech x 175 days	<u>10,500 tech-days</u>
			13,860 tech-days

TOTAL CAPACITY 30,710 tech-days

From the preceding tables we can deduce that the /16  
potential demand considerably surpasses the maximum capacity of  
the centers dedicated to teledetection. It would be possible,  
therefore, to increase the capacity of these centers several  
times without satisfying this demand.



According to present-day capacity, 7 years would be necessary simply to meet the demand of countries in groups C and D, and it would take a full 21 years to completely satisfy it. This is the case even without the constant increase in demand caused by continual growth of teledetection techniques and increases in population that necessitate modernization of production techniques.

The Harvison and Meyers Index shows figures that only approximate the minimum calculated demand. It can, therefore, be assumed that the programs at regional centers in Remote Sensing should at least approximate this data. Even assuming that the preceeding figures are incomplete and that the manner of obtaining them is empirical, they do reflect the tremendous urgency in Latin America concerning education in Remote Sensing.

We cannot, however, sit back and do nothing without trying to close the gap separating us more each day from the developed countries of the world.

## 7. CREATIVITY

In order to solve problems, it is necessary to exercise all the creativity that our institutions and organizations have available. This creativity, however, can be fully utilized only through human resources.

Creativity, therefore, is one of the requirements that /17 any person aspiring to an important role in the field of Remote Sensing should possess. Unfortunately, it is not always valued in an organization. There is often acceptance of creativity that solves simple, daily problems, as well as the kind that permits the status quo to continue and prevents others from realizing the organizational chaos that exists. Bold creativity, however, is not generally welcomed because it touches the true fibres of the organization and its environment

and means too many profound changes. People are fearful of change, as is well-known by anyone able to observe his surroundings, or anyone who has read something about this phenomenon. Any attempt at change, therefore, threatens people's security, and creativity does generate change because it is the capacity to innovate and perceive new opportunities where others do not. Through it a person can see old ideas in a new light, making the familiar seem strange and the strange seem familiar. It is, moreover, the ability to introduce reforms.

Is creativity a science? Or is it an individual aptitude of only a few select intellectuals? Or is it a moment of inspiration whose source is unknown?

Today, many writers and researchers have dared to say that the capacity to create, to innovate, to invent can be acquired like many other skills.

Until the beginning of this century it was believed that discovery and innovation would occur at the end of a logical process. Descartes, in his Discourse on Method, states that, "Asleep or awake, we ought not allow ourselves to be prevailed upon by more than the evidence of our reason and in no case by our imagination, or by our senses." It is the expression of this same tendency that prevents the imagination from /18 interfering in the invention process. Thus, the imagination becomes so suspicious that it is opposed to the concept of the scientific method.

In the United States, during the 1930's, Alex Osborn created a method called "rainfall of ideas" (translator's note: possibly "brainstorm") and restored the role of the imagination in the creative process. William Gordon also made progress in designing the synthetic method. Later on, multiple, complex, and overwhelming problems generated by the conquest of space,

contributed to the frequent, methodical, and scientific use of the imagination in the creative process without reservation.

In England, meanwhile, Edward de Bono designed a method called "lateral thought." This movement, born and expanded in the US, crossed the North Atlantic and won favor in France and England and then in other countries, allowing for further dissemination of the creative process. There are, nevertheless, few who have accomplished serious work or have kept it up sufficiently in order to put theory into practice. In Colombia, specifically, there is no evidence of creative methodology being used systematically, although some isolated efforts have been made in this area.

Venezuela is the only Latin American country whose government has initiated a praiseworthy effort to further investigate creativity and intellectual development as well as disseminate its use.

There is a big difference between technical knowledge and the ability to discover and create it. The competent specialist knows all the theories, and because of so much knowledge, is trapped like a fly in a spider's web. The innovator has less knowledge but in return has an attitude of total freedom. He is free from prejudice, he is not afraid of the ridiculous, and /19 he observes all phenomena with a new and productive vision. In this respect, remember that Pasteur was not a doctor and that Einstein's contemporaries had had a much better academic education than he. We should also keep in mind that Faraday's interest in electricity did not begin until he was over 40 years old, and that Edison did not finish his elementary school education.

The "expert" is an intellectual that relies on the knowledge related to his specialty and becomes totally absorbed in it in order to feel secure. The "inventor," on the other

hand, has more confidence in his own imagination than in his knowledge. He does not feel insecure when he no longer masters a specific area of activity because he has dedicated time to areas relating to the problems that face him: he is an intellectual open to the most general forms of knowledge.

At times the qualities of the expert and the innovator are combined in one individual. These, however, are exceptional cases. In order to overcome this unfortunate infrequency, the research ought to receive the contributions of both "experts" and "non-experts." The latter will question the stereotypical, rigid concepts of the "experts," while the former will support the knowledge of the "non-experts."

The information supplied by multidisciplinary groups is an original form of research that neutralizes the expert's rigidity and fear of innovation with the daring of the naive non-expert. In this case an individual is called naive who, although he has a good knowledge of a specific science, has no knowledge, or very little, in the area directly related to the problem discussed. Since today it is impossible to do serious study without touching several fields of knowledge, individual research is becoming increasingly rare, and group research is becoming more frequent.

The best group is the diversified one: each specialist /20 is obligated to speak in a language accessible to all. Conventional, rigid, and stereotypical ideas must yield because new situations demand manners of expression replacing what has served in the past.

In conclusion, today there is no doubt that creativity and innovation are as important as any other methodology normally employed. The success we have attained permits us to say without hesitation that we have a system of knowledge that is creative, inventive, innovative, and heuristic. Like any other

technique or science, our system can be transmitted by means of the educational and learning process.

On the other hand, it has been confirmed that a creative group, under ideal circumstances, is more productive than isolated individuals. Likewise, creativity highly stimulates any type of human activity.

Unfortunately, these methods are more extensive in countries having a high technological level than in Third World countries, and instead of decreasing, this gap continues to increase. These methods, therefore, must be disseminated in as little time as possible in order to strongly emphasize a closer relationship between research and creativity.

#### 8. CREATIVITY AND REMOTE SENSING

Stimulation of creativity and innovation is especially important in Remote Sensing's educational programs, this tool has demonstrated to be of enormous value in the development /21 process of our countries. Therefore, in referring to Remote Sensing programs within our region, we must talk about educational processes and methodological innovation because, like Third World countries, we need to make more efficient use of our scarce economic resources and scarce, although valuable, human resources.

We really need to think about creating an "attitude" toward Remote Sensing that is understood like a normal element of our education and culture, and not like the heritage of a select number of scientists. Such an attitude would mean that the child, from his early years, would not see the world portrayed in his textbooks as if were flat. Instead, from the start he would have an understanding of the third dimension. This could be achieved if, for example, anaglyphs were included in the book

instead of maps, because the child would feel as if he were flying over the zone.

Were this the case, it would not then be difficult for the secondary student to participate right from the beginning in aerial photography, stereoscopy, and cartography inclusive. And why not study photo-interpretation as well? A geography course that included a few classes in these subjects would create, without a doubt, a positive "attitude" toward Remote Sensing. Very soon high school texts should include images of sensors on board satellites, giving students the ability to understand them, even though it would be at an elementary level. The university student, consequently, would be able to participate efficiently in more advanced aspects of Remote Sensing, and the professional of tomorrow would then become an additional factor in such technology.

Present day training centers in Remote Sensing will become the focus of research and of adaptation to new technologies, /22 providing advisory and consulting services and bringing experts up to date on present knowledge.

The results of research and consultation will be incorporated into the teaching curriculum, permanently enriching the cycle. Nevertheless, one important element is not included in this perspective: the teacher.

It will be necessary at that time to undertake an aggressive campaign right in the universities where the primary and secondary teachers are trained, because it is there, with the actual education of the teachers, where all creativity and effort must begin.

If we want to reduce the gap separating us from other developed countries, we should do so because the next generation may actually be the Remote Sensing generation. This will mean

better exploration and tapping of our natural resources, giving us an improved standard of living for our people.

In closing, permit me to give an example. Professionals from different countries and different disciplines (biologists, geographers, professors, engineers, etc.) go to the post-graduate and training courses that are permanently available at CIAF. Many of these professionals have barely used aerial photography, and it is therefore necessary to start a course in Remote Sensing with the most elementary principles, which means cost and time that could be better used in specific applications of teledetection.

In addition to these experiences, the CIAF has considered the dissemination and teaching of Remote Sensing from early childhood of vital importance. The Center has, therefore, /23 recently published a child's magazine, titled "An Aerospace Trip," of which they produced 10,000 copies with free distribution in the countries' elementary and high schools, through the National Department of Education and other organizations. We are sure, nevertheless, that the results will not be those hoped for, since the person closest to the child, his teacher, has been neither motivated nor capable of assisting him in his learning.

In summary, these changes are attempting to alter Remote Sensing's pyramidal training structure to a trapezoidal structure supported by a larger and firmer base. This will be achieved through education starting in childhood and continuing into adolescence, without neglecting the higher levels. That is, we have to continue working in Geographic Systems of Information, Digital Computation and Processing, and Interactive Systems of Consultation in designing and setting up new algorithms, etc.

We also should continue training programs of regional scope, like those promoted by the CIAF. We should, however, maintain the following objective:

"If we educate children in Remote Sensing today, we will enjoy the benefits of experts tomorrow."